

FOUR NEW SPECIES OF POGONOPHORA FROM THE ATLANTIC OCEAN OFF SOUTHERN FLORIDA¹

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ABSTRACT

Four new species of Pogonophora found in 200 metres depth off Miami Beach, Florida, U.S.A., are described and discussed, and a new genus of the family Lamellisabellidae is erected to contain one of the new species. The distinctive characters of the genera *Oligobrachia* and *Nereilinum* and of the orders Athecanephria and Thecanephria are discussed. Finally the function of the spermatophores is discussed.

INTRODUCTION

The four new species described below were obtained from a muddy bottom off Miami Beach, Florida, U.S.A. (25°48'N; 80°00'W) by using a heavy, triangular dredge. Many specimens of the three first described species were found on both 25 and 29 March 1965, whereas only two specimens of the fourth species have been found, both on 29 March. The depth was about 200 meters and the temperature of the mud just brought up was 8.5°C.

To gain some information about the animal community in which the pogonophores occurred and their abundance on the bottom we tried to take some samples with a van Veen grab, but none of the hauls were successful. Instead, a list of the associated fauna found in the dredge hauls of 29 March is given in Table 1.

All the tubes of the pogonophores were examined before preservation, and many of them contained an animal, which was then in most cases squeezed out of the tube. The specimens were examined alive and afterwards the material from 25 March was fixed in Bouin's fluid, while the material from 29 March was fixed in 4 per cent formalin in sea-water. Later, after the drawings had been made, the whole material was transferred to 70 per cent alcohol.

The holotypes are deposited in the U.S. National Museum. The paratypes, as well as the other material, are kept in the Zoological Museum, Copenhagen, Denmark.

The material was collected by the author during a stay at the Institute of Marine Science, University of Miami. My most sincere thanks are due to the Nordic Council for Marine Biology for the fellowship to Miami and to Dr. F. G. Walton Smith and the staff of the Institute of Marine Science for great help and enthusiasm. Thanks are also due to Prof., dr. G. Thorson of the Marine Biological Laboratory, Helsingør, Denmark, and to the late

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TABLE 1

A LIST OF THE ANIMALS FOUND TOGETHER WITH THE FOUR POGONOPHORE SPECIES ON 29 MARCH 1965

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- FORAMINIFERA (det. Dr. A. Nørvang, Copenhagen)
Cibicides bertheloti (d'Orbigny) on a tube of *Siboglinum*
Cibicides sp. on a tube of *Oligobrachia*
- ANTHOZOA (det. Dr. F. Jensenius Madsen, Copenhagen, and C. E. Cutress, Washington)
Andwakia isabellae Carlgren & Hedgpeth
Halcampoides sp. (?)
 Cerianthariid
- NEMERTINI (det. Mag. scient. lise Overgaard Nielsen, Aarhus)
Cerebratulus sp.
- ENTOPROCTA (determined by the author)
Loxosomella phascolosomata (Vogt) (?) on *Golfingia*
Loxosomella sp. on the tubes of *Praxillura*
- POLYCHAETA (det. N. Kenneth Ebbs, Jr., M. Sci., Miami)
Aphrodita acuminata Ehlers
Panthalis sp.
Hermodice carunculata (Pallas)
Onuphis eremita oculata (Hartman)
Lumbrineris sp.
Praxillura ornata Verrill
Eupolymnia crassicornis (Schmarda)
- SIPUNCULIDA (det. Mag. scient. Elise Wesenberg-Lund, Copenhagen)
Golfingia sp.
- CRUSTACEA (det. Dr. L. B. Holthuis, Leyden)
Lyrideus bairdii Smith
Acanthocarpus alexandri Stimpson
Pilumnoplax elata (A. Milne Edwards)
Nephropsis aculeata Smith
- LAMELLIBRANCHIATA (det. Dr. D. R. Moore, Miami, Dr. Kenneth Boss, Washington and Dr. J. Knudsen, Copenhagen)
Nuculana platessa (Dall)
Vesicomys venusta Dall
Lucina filosa (Simpson)
Loripes lens (Verrill & Smith)
 Pholadid
- CEPHALOPODA (det. Mr. Richard Young, M. Sci., Miami)
Rossia tenera (Verrill) (?)
- ECHINODERMATA (det. Dr. Lowell Thomas, Miami)
Amphiura otteri Ljungman
Amphiura semierrmis Lyman
Amphilimna olivacea (Lyman)
Ophiura acervata (Lyman)
- PISCES (det. Mr. Jon Staiger, Miami)
Symphurus sp.
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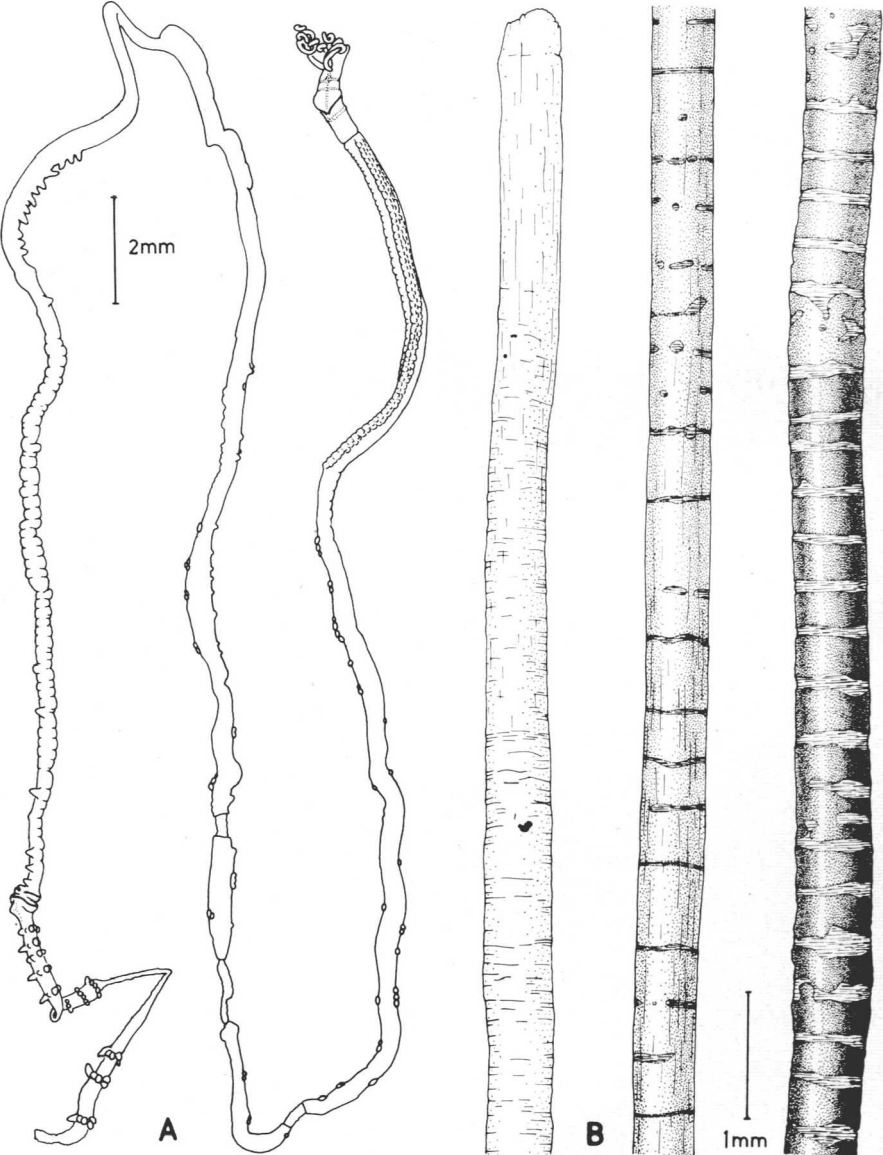


FIGURE 1. *Oligobrachia floridana* sp. nov.: A, the holotype; B, selected pieces of tubes.

Prof., dr. R. Spärck of the Zoological Institute, Copenhagen, Denmark for excellent laboratory facilities during my subsequent working up of this material. Dr. C. Little has kindly read the proofs of this paper and corrected the English language.

DESCRIPTIONS OF THE SPECIES

***Oligobrachia floridana*, sp. nov.**

Figs. 1-3

Material.—Several fragments of tubes with animals. The specimen selected as holotype lacks the posterior part of the post-annular region; one more specimen shows the annuli, but all the other specimens are even less complete.

Description.—The fore-body (fore part of the body or protosoma + mesosoma in Ivanov, 1963) is cylindrical and rather long, the length: breadth ratio being about 7 in the living animal. The cephalic lobe is long, triangular and a little flattened. A pretentacular furrow has not been observed in the living animal, but the preserved specimens often show a weak constriction in the region of the tentacles. There are four long tentacles placed very close together in a square, which is more or less rotated so that the tentacles of the right side are situated a little in front of the ones of the left side. The pinnulae are arranged alternating in two rows which are very close together. The distal pinnulae measure about $120\ \mu$ in length.

Behind the tentacles are two deep annular grooves, crossed by a wide ventral groove which proceeds backwards to the bridle. The keels of the bridle nearly meet on the ventral side, in a right angle, and they are clearly separated on the dorsal side where their thin ends connect with the posterior, annular groove. The bridle looks uncomplicated when observed under low magnification, but mounted in balsam and examined with an oil-immersion objective it is found to consist of small transverse thickenings of the cuticula almost like that of *Siphonobrachia ilyophora* (see Fig. 9A). Behind the bridle is a white glandular girdle which is widest just at the sides of a mid-ventral interruption. There is a deep furrow between the fore-body and the "metameric" part of the trunk.

The glands of the metameric part do not form separate papillae but are arranged irregularly on a pair of lateral ridges on the sides of the ventral sulcus. Just behind the metameric region the glands are found on the ventral side too, but they soon become very scarce and finally disappear altogether. There is some variation in the arrangement of the glands, and in some specimens protruding groups of glands can be found behind the metameric region. It seems as if the boundary between the metameric and the non-metameric regions is not quite established. Behind the region with the glands follows a long, cylindrical region with scattered, small papillae.

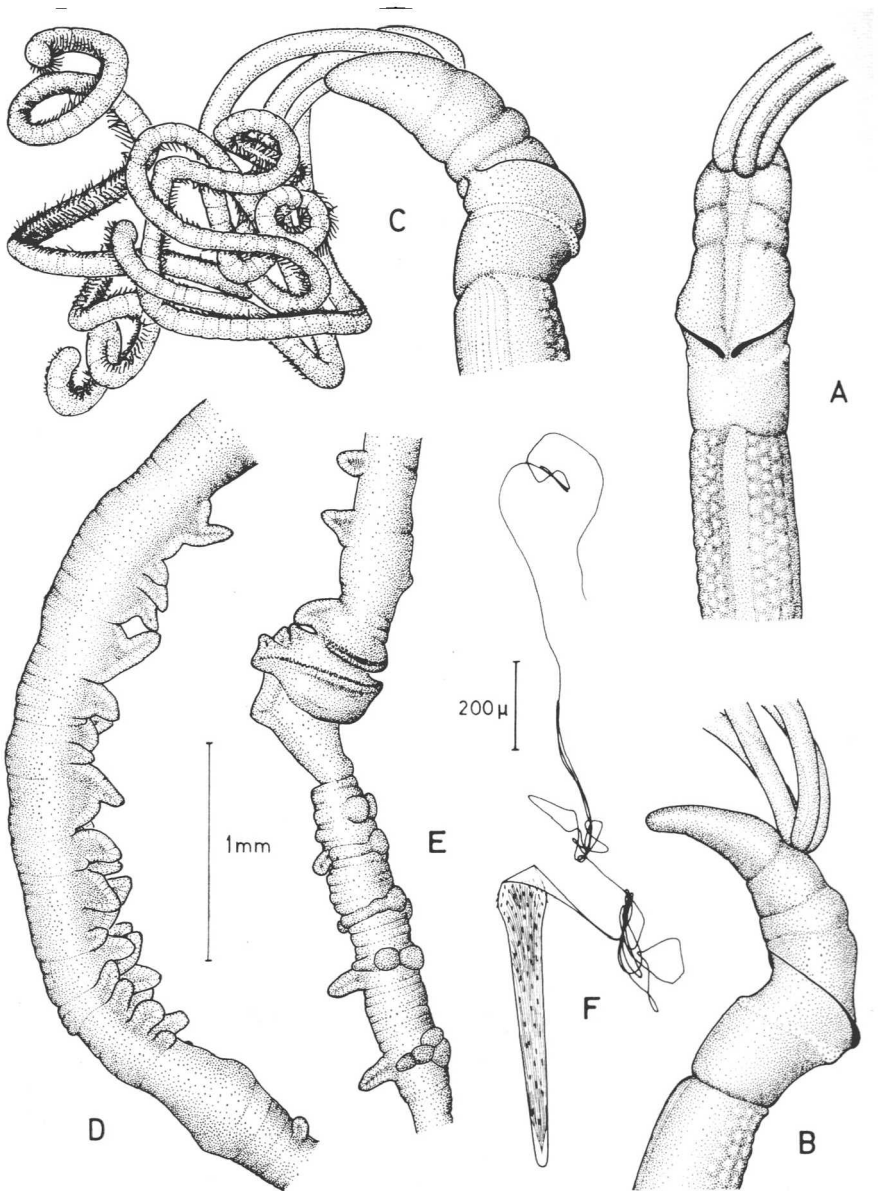


FIGURE 2. *Oligobrachia floridana* sp. nov.: A-C, the fore-body of a specimen with well preserved tentacles, ventral, lateral, and oblique dorsal views respectively; D, the region of thickened papillae of the holotype in lateral view; E, the annuli and the anterior part of the postannular region of the holotype in lateral view; F, spermatophore (the 200 μ scale).

The female genital openings are found about midway between the metameric region and the annuli. The region of the thickened papillae has 30-35 irregular papillae. The rather long region between the thickened papillae and the annuli has a few rather large, mid-ventral papillae and just in front of the annuli five to six big papillae are found close together. On the tip of all these papillae is found a colourless, transverse thickening of the cuticula with a width of 30-35 μ .

There are two annuli which are both wide open on the ventral side. They consist of about two rows of irregularly arranged platelets, which show the posterior group of teeth only. The platelets measure 11-16 $\mu \times 3-5 \mu$. A few almost circular platelets have also been observed. Just behind the annuli, a large ventral papilla is followed by a constriction of the body.

The postannular region is very characteristic with rings of papillae, of which the ventral one is large and more or less conical, the ventro-lateral ones more rounded and the latero-dorsal and dorsal ones cushion-shaped.

The preserved holotype has the following dimensions: Length of the fore-body 1.9 mm, breadth of the fore-body 0.50 mm, length of the preannular part of the trunk 61.5 mm, breadth at the girdles 0.55 mm, length of the postannular fragment about 9 mm. A living specimen had tentacles 40 mm long, and the length and breadth of the fore-body were 3.0 mm and 0.42 mm respectively. One of the longest tubes measured 26 cm and contained a specimen measuring 72 mm from the tip of the fore-body to the girdles and about 0.4 mm across the fore-body.

The spermatophores measure about 660 $\mu \times 120 \mu$; they are spindle-shaped with small wings at the base of the filament.

The tubes are rather elastic and have a thin, colorless, membranous region at both ends. The more thick-walled region is whitish with a few rather short, brownish portions. The tubes show the usual arrangement of rings but no segmentation. The longest tube measured 33 cm with a

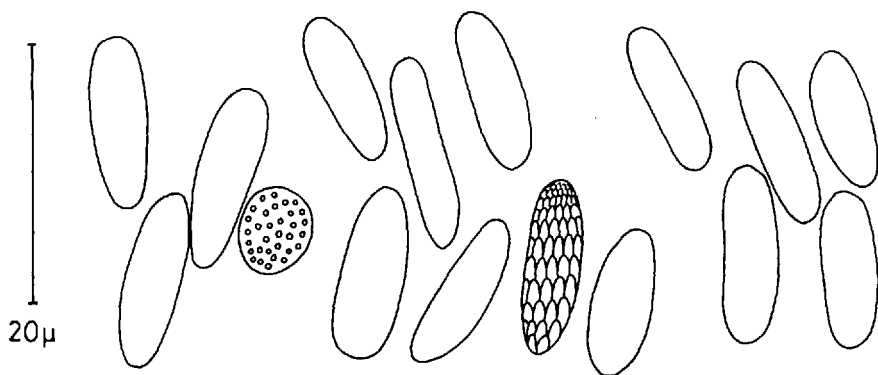


FIGURE 3. *Oligobrachia floridana* sp. nov. Toothed platelets.

diameter varying between 425 μ and 535 μ ; the largest tube had a diameter of 540 μ . Several specimens of *Cibicides* sp. (Foraminifera) were found on the thin end of one of the tubes.

Discussion.—This species is a typical member of the family Oligobrachiidae, having continuous lateral ridges with glands instead of rows of metamerically arranged papillae on the anterior part of the trunk and having a rather small number of tentacles. Ivanov (1963) uses characters of the tentacular crown to distinguish the two genera *Oligobrachia* and *Nereilinum*, the former having 6-9 tentacles with pinnulae and the latter having 2 tentacles without pinnulae. *Oligobrachia floridana* and the new species of *Nereilinum* described below are more or less intermediate between these diagnoses as the former has 4 tentacles with pinnulae and the latter 2 tentacles with pinnulae. The presence or absence of pinnulae can hardly be taken for a character of generic value since some species of *Siboglinum* have pinnulae while others are lacking them (Ivanov, 1963 tab. 2). However, both the previously described species of *Oligobrachia* and *O. floridana* have a non-transparent fore-body-wall and spermatophores with small wings at the base of the filament, while *Nereilinum murmanicum* and the new species described below have a transparent body-wall (so that the glands of the fore-body can be seen by transparency) and spermatophores without wings. It seems therefore justified to retain the two genera with the following, slightly modified diagnoses: *Oligobrachia* Ivanov, 1957: with 4-9 tentacles; the pyriform glands of the fore-body can not be seen by transparency; the spermatophores have wings at the base of the filament. *Nereilinum* Ivanov, 1961: with 2 tentacles; the pyriform glands of the fore-body can be seen by transparency; the spermatophores lack wings.

Some of the more important distinctive characters of the species of *Oligobrachia* and *Nereilinum* are given in Table 2.

***Nereilinum punctatum*, sp. nov.**

Figs. 4, 5

Material.—Several fragmentary animals and tubes. All the specimens lack the posterior bulb but two of them have retained a good portion of the postannular part of the trunk.

Description.—The fore-body is long and cylindrical with a length:breadth ratio of about 7 in the most relaxed one of the preserved specimens. The cephalic lobe is middle-sized, triangular and rather flattened. There is usually no pretentacular furrow. There are two tentacles with pinnulae alternating in two rows and orange-brown spots in two lateral rows; sometimes there are also rings of this pigment around the basal part of the tentacles. The pinnulae may attain a length of about 165 μ .

Behind the bases of the tentacles is found a depressed area, which is

bright orange-colored in the living animal, while it looks more brownish-red in the preserved specimens. The pigmentation of the rest of the body is rather variable but this orange spot is always very characteristic. From the sides of the depression two small grooves run backwards on to the dorsal side where they connect with the very fine tips of the keels of the bridle.

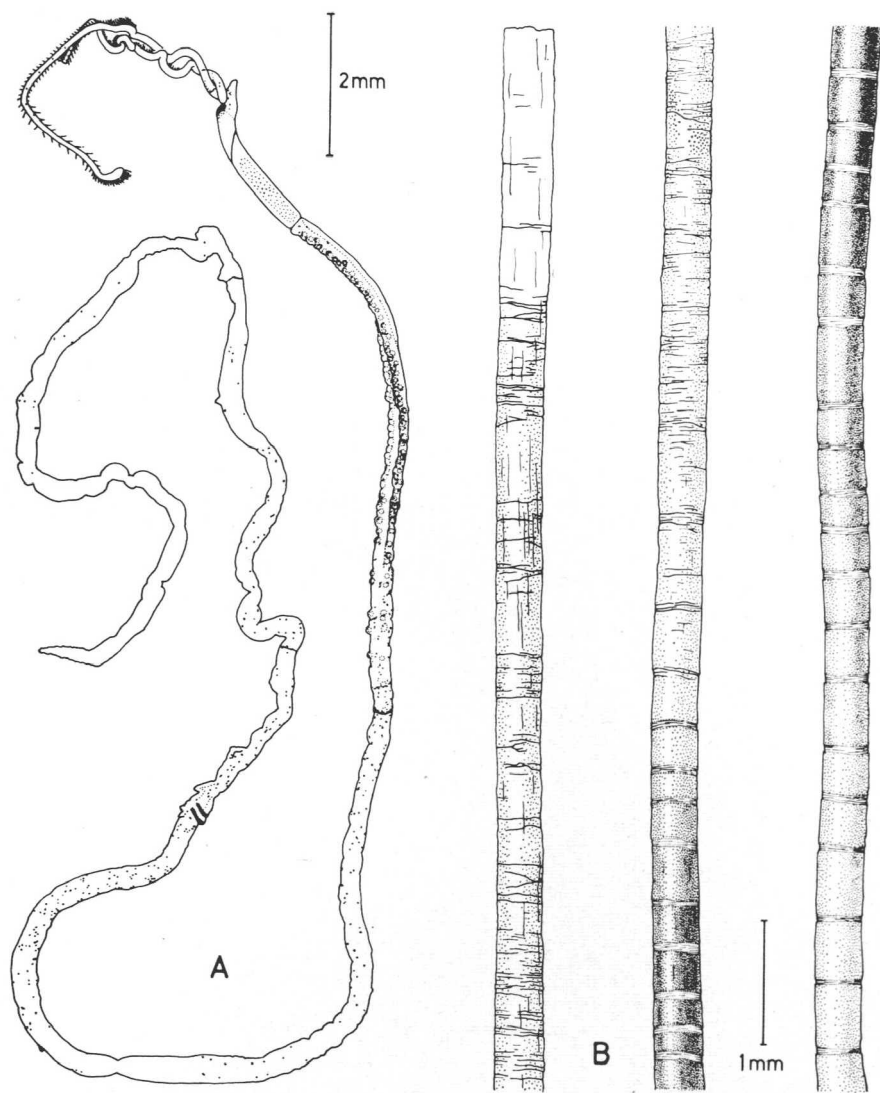


FIGURE 4. *Nereilinum punctatum* sp. nov. A, the holotype; B, selected pieces of tubes.

TABLE 2
CHARACTERISTICS OF THE SPECIES OF *Oligobranchia* AND *Nereilinum*

	<i>O. dogieli</i>	<i>O. ivanovi</i>	<i>O. floridana</i>	<i>N. murmanicum</i>	<i>N. punctatum</i>
Breadth: length ratio of forebody	1:8	1:6	1:7	1:6-10	1:7
Number of tentacles	6-9	7	4	2	2
Pinnulae	+	+	+	-	+
Pretentacular groove	-	+	(-)	-	(-)
Keels fused dorsally	-	+	-	-	-
Cuticular adhesive plaques	-	+	(+)	-	(+)
Girdles	Broken	Complete	Broken	Broken	Broken
Length of toothed platelets (μ)	16-23	?	11-16	15-18	13-17
Breadth of metasoma (μ)	300-400	500	500	150-320	310
Length of spermatophore (μ)	240	850	660	c. 100	250

Another narrow groove runs mid-ventrally from the depressed area to the bridle. The bridle itself is uncomplicated and very thin and the keels meet ventrally, almost at right angles. On the ventral side just behind the bridle is found a wide band of whitish cells. The region between the bridle and the metameric part of the trunk is long and its sides appear filled with oblong glands which are easily seen by transparency. In some of the preserved animals this region is covered with some long hairy structures, probably the preserved secretion of the just-mentioned glands.

In the "metameric" region a ventral sulcus is bordered by a pair of whitish lateral ridges with big glands, which are irregularly arranged in about two rows in the anterior part, while they form one more or less regular row on the posterior part. Several small greyish-brown to brown pigment-spots are found on the ridges and they are often arranged more or less in circles around the big glands. In some specimens the pigment is less concentrated and appears as larger light grey-brown areas. Sometimes a whitish, protruding band borders the dorsal ciliary field. Behind the "metameric" region only few glands are found. The female genital openings are situated about midway between the metameric region and the region of the thickened papillae. In some specimens one or two narrow, greyish-brown transverse ridges are found between the metameric region and the girdles, but neither their presence nor their position are constant. The whole body behind the metameric region is more or less densely dotted with greyish-brown to brown pigment spots.

The region of the thickened papillae seems always to have 16 papillae and there is a more or less conspicuous constriction of the body just in front of the first papilla. There are four to five small ventral papillae just in front of the girdles and a few papillae may also be present in the ventral openings of the girdles. On the tip of each papilla is found a small, colorless, transverse thickening of the cuticula.

There are two girdles which are both wide open on the ventral side, while only the anterior one has a small opening on the dorsal side. The toothed platelets form about two irregular rows on each girdle. They are of a normal shape with a vague constriction between the anterior and posterior teeth of which the latter are more developed than the former. The platelets measure $13-17 \mu \times 5-6 \mu$.

Behind the girdles is found a big ventral papilla followed by a constriction of the body. The postannular region shows no dorsal glandular shields or glandular areas, and there are scattered transverse rows of one to three ventral and ventro-lateral papillae. Each of these papillae has a small transverse cuticular thickening like those of the thickened papillae.

The holotype has the following dimensions: length of the fore-body 2.29 mm; breadth of the fore-body 0.31 mm; length of the tentacles about 6.5 mm; length of the preannular part of the trunk about 21 mm; breadth

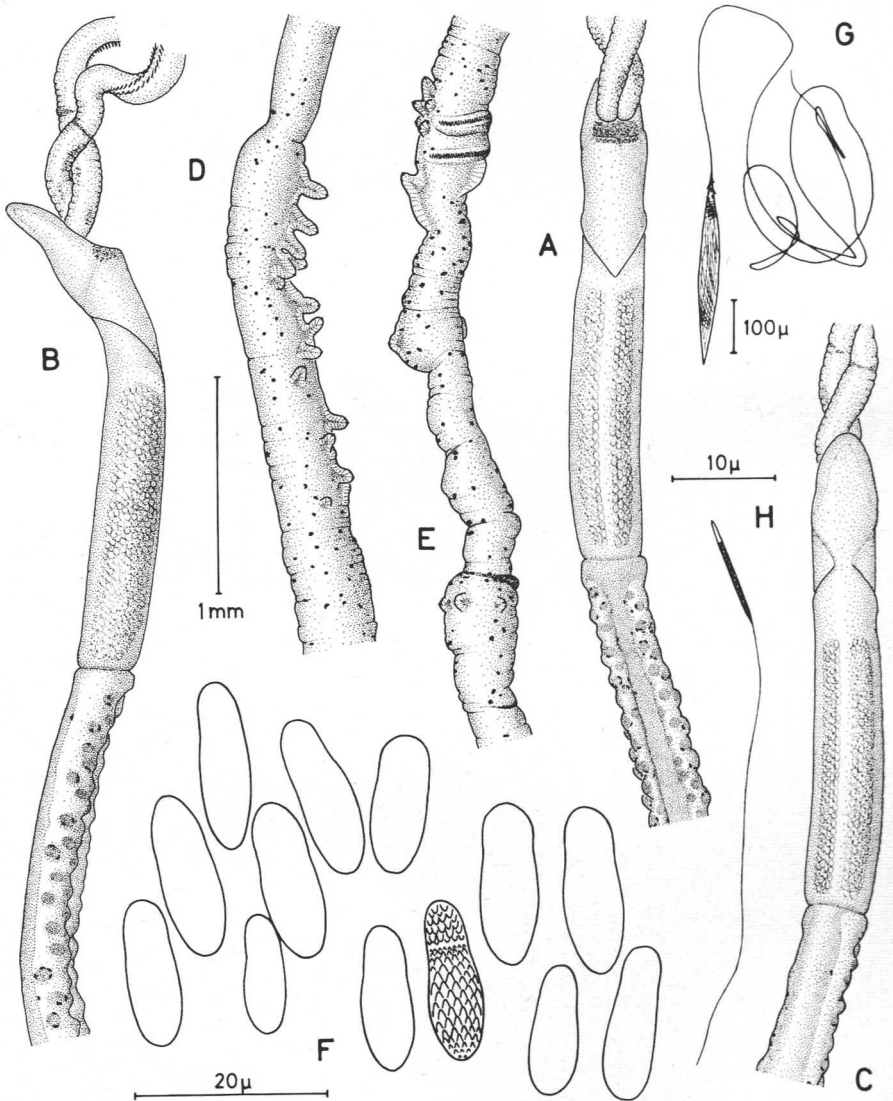


FIGURE 5. *Nereilinum punctatum* sp. nov.: A-E, the holotype: A-C, the fore-body in ventral, lateral, and dorsal views respectively; D, the region of thickened papillae, lateral view; E, the annuli and the anterior part of the postannular region in lateral view; F, toothed platelets (the 20 μ scale); G, spermatophore (the 200 μ scale); H, living spermatozoon (the 10 μ scale).

of the trunk at the girdles 0.37 mm; length of the postannular fragment about 20 mm.

The spermatophores are spindle-shaped and measure $350\ \mu \times 35\ \mu$; they have a long and very fine filament. The spermatozoa have a spindle-shaped head with a diameter somewhat below $1\ \mu$ and a length of $18\ \mu$; their tail is about $45\ \mu$ long.

A few of the females had embryos in the tubes.

The tubes are thin and elastic and have flimsy portions at both ends. They are colorless for most of their length, but a light brown region is usually present near one end of each tube. The tubes show the usual rings, but there is no sign of segmentation in the main region. The longest tube measured 22.8 cm with a diameter of 265-425 μ ; the largest fragment had a diameter of 450 μ .

Discussion.—The structure of the postannular region seems to indicate that this species belongs to the Thecanephria, but a series of sections have not revealed the characteristic excretory system of that order. I have therefore referred it to the Athecanephria and to the family Oligobrachiidae because of its continuous lateral ridges with scattered glands on the preannular part of the trunk. As described above, the species is referred to the genus *Nereilinum* because of its small number of tentacles and its spindle-shaped spermatophores; and it differs from *N. murmanicum* in its coloration and by having pinnulae on the tentacles. Some of the more prominent distinctive characters of the genera *Oligobrachia* and *Nereilinum* can be found in Table 2.

***Siboglinum mergophorum*, sp. nov.**

Figs. 6, 7

Material.—Several fragments of animals and tubes. None of the specimens show the posterior bulb, but a long postannular part is present in several of them.

Description.—The fore-body is very long and cylindrical with a length: width ratio of 11.5 in the holotype, but down to about 7.5 in more contracted specimens. The cephalic lobe is long, triangular and a little flattened. There is no pretentacular furrow. The tentacle, which has a slender tip, has two close rows of alternating pinnulae, which may attain a length of a little more than 200 μ . Behind the tentacle four furrows are seen; the first one completely encircles the fore-body; the second one runs obliquely backwards and its lateral ends connect with the fine tips of the bridle on the dorsal side; the two posterior furrows are confined to the ventral side. The thin keels of the bridle meet on the ventral side at nearly 90°, but are widely separated on the dorsal side. Just behind the bridle two whitish ventro-lateral patches are found. A most characteristic feature

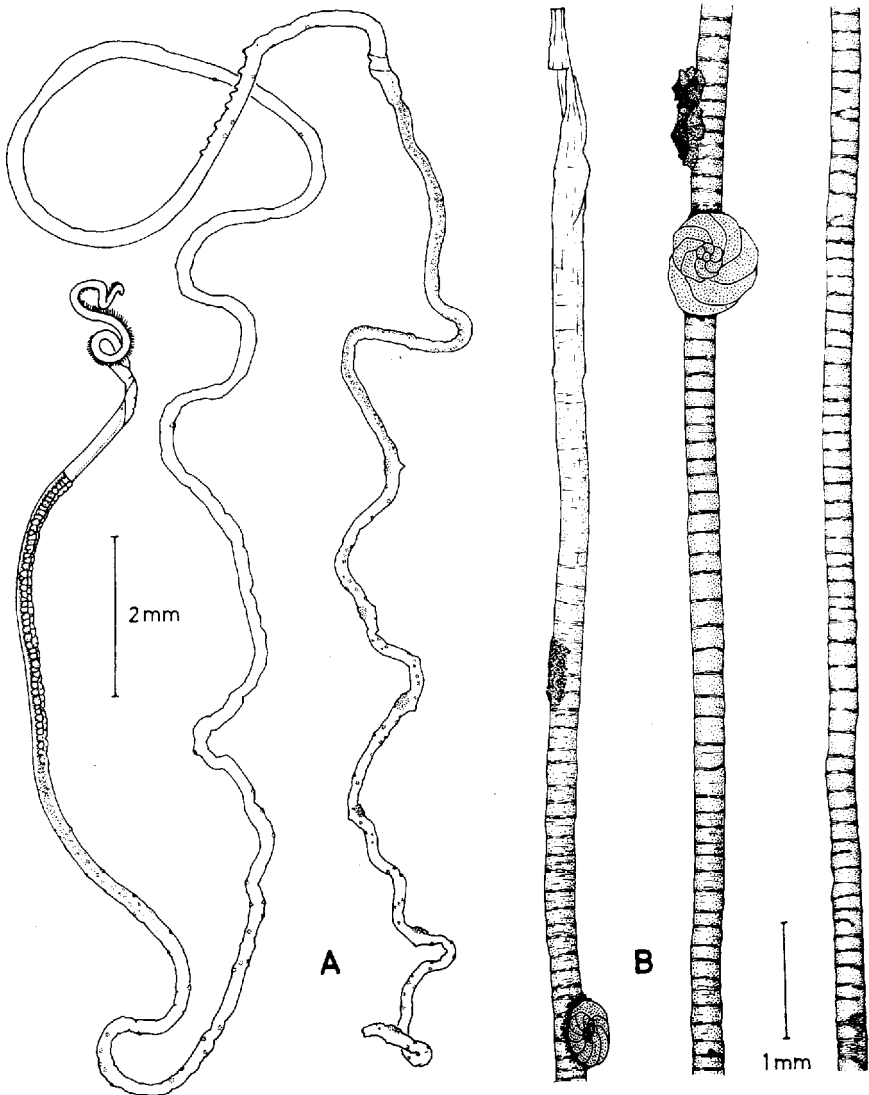


FIGURE 6. *Siboglinum mergophorum* sp. nov.: A, the holotype; B, selected pieces of tubes.

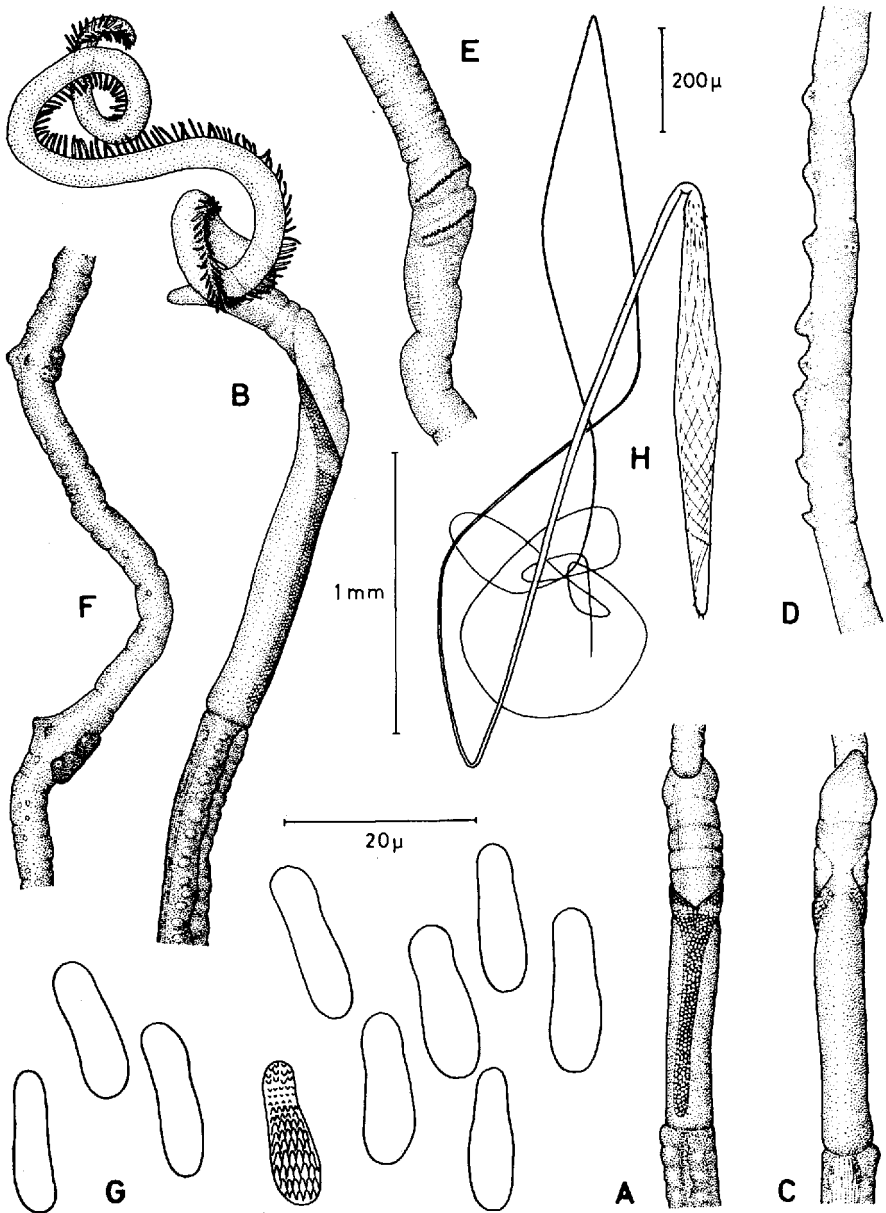


FIGURE 7. *Siboglinum mergophorum* sp. nov.: A, fore-body in ventral view; B, the fore-body of the holotype in lateral view; C, fore-body in dorsal view; D, the region of thickened papillae in lateral view; E, the annular region in lateral view; G, toothed platelets (the 20 μ scale); H, spermatophore (the 200 μ scale).

of this species is a Y-shaped, protruding figure, the handle of which stretches along the midventral line of the fore-body almost to the metameric region, while the two arms follow the keels of the bridle to the dorsal side.

The metameric region shows a pair of ventro-lateral ridges each containing about 45 big glands, and a rather narrow sulcus. A large number of small white dots are seen on the ridges, most often forming circles around the big glands and an almost unbroken lateral band. The non-metameric part of the pre-annular region is very long and has scattered whitish glands. The region of the thickened papillae shows 7-10 papillae in one row.

The two annuli are both wide open ventrally, and the anterior one has a very small interruption dorsally, while the posterior one is unbroken dorsally. The toothed platelets form about two rows. Their posterior group of teeth is more than twice as big as the anterior, and there is a constriction between the two areas of teeth. The platelets measure $15-17 \mu \times 4-5 \mu$.

The anterior part of the postannular region shows a great number of small white dots on the ventral side. Each of the dorsal shields is more or less distinctly divided into an anterior and a posterior part and there is a transverse row of 1-5 small papillae opposite each of these dumb-bell shaped dorsal shields.

The longest specimen had the following dimensions: length and width of the fore-body 1.96 mm and 0.21 mm respectively; length of the preannular part of the trunk 37 mm; diameter at the annuli 0.25 mm; length of the postannular fragment 38 mm. One specimen had a tentacle that was 5 mm long.

The spermatophores are spindle-shaped and measure about $800 \mu \times 85 \mu$; their filament has a stout proximal region.

The tubes are whitish, sometimes with a brownish tint in some regions. They are thin and densely ringed. The longest tube measured 20.9 cm with a diameter of 195-250 μ . An unusually thick fragment had a diameter of 410 μ . Several specimens of *Cibicides bertheloti* (d'Orbigny) (Foraminifera) have been found on the tubes.

Discussion.—This species is easily recognized by its protruding Y-shaped area on the fore-body. Glandular strips of about the same shape are found in several other species of *Siboglinum* (*S. taeniophorum* Ivanov, *S. atlanticum* Ivanov, and *S. lacteum* Southward) but in all these species the strips are apparently not protruding and furthermore they form a pair of latero-ventral bands instead of a single mid-ventral band. Another characteristic feature of *S. mergophorum* is the unusually large spermatophores (800 μ); none of the species of *Siboglinum* described heretofore have had spermatophores longer than 500 μ (*S. atlanticum*). (In Ivanov's figs. 113, 119E, and 120H (Ivanov, 1963), 0.5 mm for the length of the rule is apparently a misprinting for 0.05 mm).

***Siphonobrachia ilyophora*, gen. et sp. nov.**

Figs. 8, 9

Material.—Two fragments of animals and their tubes; the specimen selected as holotype is lacking the postannular part, and the other specimen, which is rather badly preserved, consists of the preannular part only.

Description.—The fore-body is cylindrical and rather short, the length: breadth ratio being about 2.3 in the holotype, which is somewhat contracted, and 3.0 in the other specimen. The cephalic lobe is more or less triangular and markedly flattened, especially on the ventral side, which is even a little concave in one specimen; its dorsal side is whitish. The tentacular crown consists of 14-18 long tentacles which are rather loosely united into a cylinder. The fore-body shows several furrows in the holotype (see Fig. 8), but since these are lacking in the other specimen their presence may be caused by contraction of the animal.

The bridle is found on a protruding ridge and its two brownish-grey keels do not meet at all on the dorsal side, but come very close to each other on the ventral side. The lateral and dorsal portions of the keels look simple while the ventral portions are quite complicated with many small, irregular, rod-like, transverse thickenings of the cuticle. Behind the bridle a pair of dorso-lateral white-dotted areas are found.

The metameric part of the trunk is comparatively long, and the papillae are fused together in the anterior part to form a pair of lateral ridges bordering a deep sulcus. Posteriorly the papillae gradually become more distinct and the last pairs of the metameric papillae are almost spherical. Each row consists of about 80 papillae, each with a cuticular plaque on the tip. The plaques on the anterior papillae are oval to kidney-shaped with a frontal zone of small greyish-brown thickenings. The plaques of the non-metameric papillae are kidney-shaped with somewhat more conspicuous thickenings and with small dots on the posterior half.

Behind the metameric region the whole body suddenly becomes a little thicker, the ventral sulcus disappears and the papillae become scattered, less protruding and somewhat smaller, but they are still arranged in two lateral rows. Furthermore, small whitish papillae without plaques appear on the lateral sides of the body and posteriorly also on the ventral side. Just in front of the girdles the rows of papillae become more dense and unify into one irregular row, perhaps corresponding to the zone of thickened papillae of many other pogonophores.

There are two girdles which are both open on the ventral side and unbroken on the dorsal side. They consist of a large number of toothed platelets in several rows. The platelets have only forward-directed teeth and they measure $14-18 \times 3-5 \mu$. Behind the girdles is found a very big papilla without any plaque.

The holotype has the following dimensions: length of the tentacles

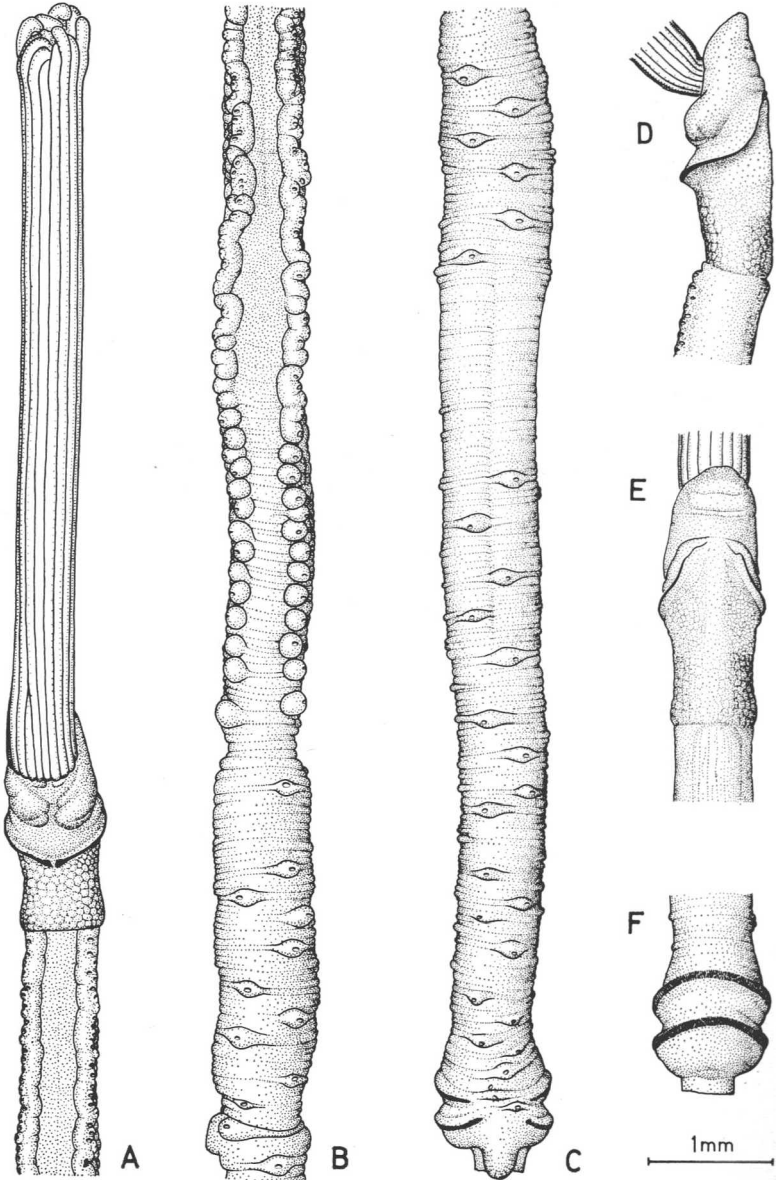


FIGURE 8. *Siphonobrachia ilyophora* gen. & sp. nov.: The holotype: A-C, in ventral view; D-E, the fore-body in lateral and dorsal views respectively; F, the annular region in dorsal view.

5.9 mm; width of the tentacular crown 0.5 mm; length of the fore-body 1.0 mm; maximum width of the fore-body (at the bridle) 0.85 mm; length of the metameric part of the trunk 7.5 mm; length of the non-metameric part of the trunk 12 mm; width at the girdles 0.95 mm.

Spermatophores have not been observed.

The two tube fragments available show neither rings nor segmentation; they are about 0.8 mm in diameter and incrustated with mud. The tube of the holotype has apparently been broken, and a new end has been formed in the same way as described for some species of *Siboglinum* and *Sclerolinum* (Webb, 1964a); the whole fragment is 76 mm long.

Discussion.—The structure of the tentacular crown indicates that *Siphonobrachia ilyophora* belongs to the family Lamellisabellidae. The plaques of the papillae are, however, not of the characteristic horse-shoe-shaped type found in all hitherto described species of this family and I have therefore decided to erect a new genus for this species.

Diagnosis of Siphonobrachia, gen. nov.—Pogonophora with a large number of tentacles which are rather loosely united into a hollow cylinder. The anterior glands of the metameric part of the trunk are found in a pair of continuous lateral ridges, but further back the ridges gradually split up into individual papillae of which the posterior ones are nearly spherical. The metameric region is nearly as long as the ametameric, preannular region. The plaques found on top of the glands are oval to kidney-shaped with complicated chitinous thickenings on the anterior part. The genus is referred to the family Lamellisabellidae. Type-species: *Siphonobrachia ilyophora*. (*Siphonobrachia*, f.—Greek: tube-armed).

A DISCUSSION OF THE DISTINCTIVE CHARACTERS OF THE ORDERS ATHECANEPHRIA AND THECANEPHRIA

According to Ivanov (1963), the Pogonophora can be divided into two orders named Athecanephria and Thecanephria. The most important distinctive character is, as indicated by the names, the morphology of the excretory organs, i.e., the coelomoducts of the first coelomic sac. In the Athecanephria the "coelomoducts are wide apart with their excretory sections closely adjoining the lateral cephalic vessels" (*op. cit.* p. 154), while in the Thecanephria "the excretory sections of the coelomoducts of the protosoma approach the boundary of the metasoma in the median plane, where they lie in sac-shaped ventral extensions of the dorsal blood vessel" (*op. cit.* p. 331). Also the shape of the first coelomic sac itself is said to be different in the two orders, the Athecanephria having a sac-shaped protocoele, and the Thecanephria, a horse-shoe-shaped protocoele.

In addition to these clear-cut characters, which are unfortunately only visible in sections, some other characters are also given, and they will be considered somewhat in detail in the following paragraphs.

(1) In the Athecanephria the postannular part of the trunk is said to have metameric dorsal shields or more or less metameric glandular portions of the dorsal integument, and usually to lack transverse rows of cuticular plaques on the ventral side; while that region in the Thecanephria is said to lack dorsal shields or glandular areas and to have metameric transverse rows of adhesive cuticular plaques (*op. cit.* p. 152). These structures are however not stable: The dorsal shields are weakly developed in *Oligobrachia dogieli* Ivanov (*op. cit.* p. 158), *Siboglinum taeniophorum* Ivanov (*op. cit.* p. 261) and *S. ceylonicum* Ivanov (*op. cit.* p. 303) and there are no dorsal shields but merely dorsal glandular areas in *Siboglinum silone* Ivanov (*op. cit.* p. 298) and *S. holmei* Southward (Southward, 1963, p. 516); finally *Nereilinum punctatum*, described above, has no dorsal glandular areas at all on the postannular region. The presence of dorsal shields can therefore not be considered an absolute character of the

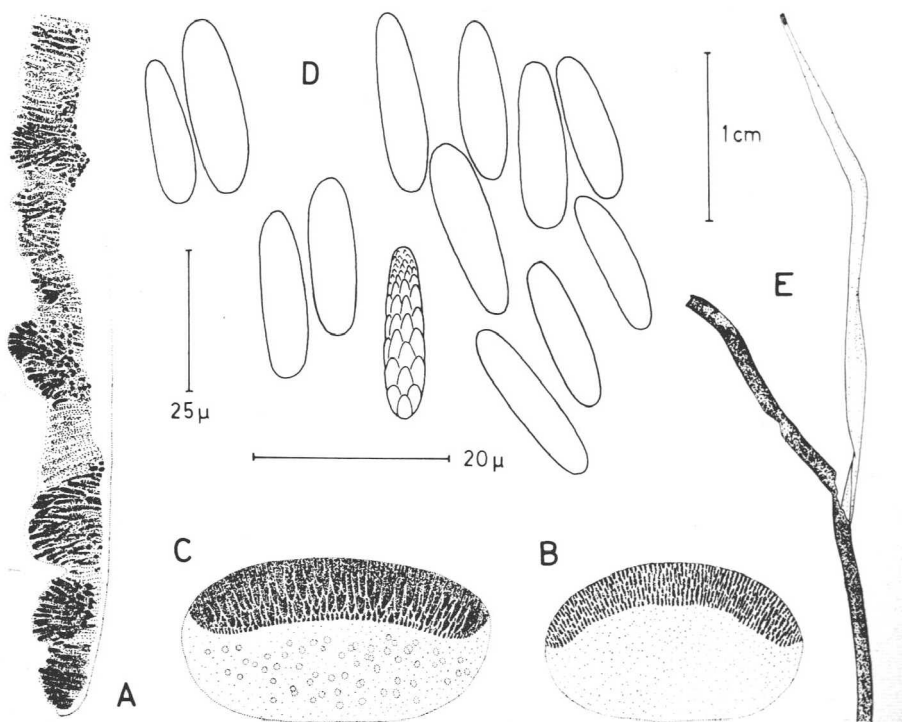


FIGURE 9. *Siphonobrachia ilyophora* gen. & sp. nov.: A, the ventral part of the left keel of the bridle of the paratype; B-C, plaques from the paratype; B, plaque from one of the first of the metameric papillae; C, plaque from one of the non-metameric papillae; D, toothed platelets from the holotype (the 20 μ scale); E, the anterior part of the tube of the holotype (the 1 cm scale).

Athecanephria. Neither are the transverse rows of papillae with cuticular plaques on the ventral side of the postannular region restricted to species of the Thecanephria. Transverse rows of papillae are found in *Siboglinum ekmani* Jägersten (Ivanov, 1963, p. 323), *S. atlanticum* Southward & Southward (*op. cit.* p. 266) and *S. lacteum* Southward (*op. cit.* p. 323) but none of these species are recorded as having plaques on the papillae. However, both *Oligobrachia floridana* and *Nereilinum punctatum* (both described above) have transverse rows of papillae with small, transverse, cuticular protrusions. All these species have a big mid-ventral papilla and smaller ventro-lateral and lateral ones, while the members of the Thecanephria usually seem to have rows of similar papillae; but in *Lamellisabella minuta* Ivanov the median papilla is bigger than the other ones (*op. cit.* p. 441) and *Heptabrachia talboti* (Southward) seems to have only one papilla in each "row" (*op. cit.* p. 356).

The morphology of the postannular region is thus to be used with great care when one is going to decide where to place new genera of pogonophores.

(2) Another character used by Ivanov (1963, p. 152) in his key to the Pogonophora is the shape of the spermatophores, the Athecanephria having spindle-shaped and the Thecanephria leaf-shaped spermatophores. There is, however, one exception to this, viz. *Zenkevitchiana longissima* Ivanov, which is referred to the Thecanephria although it has spindle-shaped spermatophores. Furthermore the spermatophores of *Diplobrachia japonica* Ivanov and *Spirobrachia grandis* Ivanov are more or less intermediate between the slender *Siboglinum*-type spermatophores and the broad type of most members of the Thecanephria. Neither can the shape of the spermatophores therefore be used as an absolute character for distinguishing the two orders mentioned.

(3) The two last characters used by Ivanov are whether the tentacles are free or fused and whether the tubes have flimsy ends or ends with a hard funnel, and Ivanov states that the Athecanephria have free tentacles and flimsy tube-ends, while the characters mentioned are varying within the Thecanephria.

The conclusion must be that the internal anatomy must be considered whenever doubt arises about the systematic position of a genus. And it must furthermore be stressed that detailed anatomical analyses of the fore-bodies of different pogonophore genera (accompanied by drawings or photographs of characteristic sections) can give important contributions to our understanding of the systematics of this group. Thus, the internal anatomy of the family Sclerolinidae is unknown and, although Webb's opinion (Webb, 1964b, p. 57) that this family must be referred to a new order is probably correct, nothing can be said about the relationships of this new order with the previously established orders before an anatomical study is available.

ON THE FUNCTION OF THE SPERMATOPHORES IN THE POGONOPHORA

Two theories have been put forward about the transference of the spermatophores from the male to the female in the Pogonophora. One is held by Ivanov (1963, p. 97) and Webb (1963a, p. 42) who believe that the spermatophores are shed into the water where the filament unwinds and functions as a floating device; the spermatophores are then thought either to be caught directly by the tentacles of a female or first to get entangled in the tube and then picked up. Webb (1963b, p. 47) has directly observed the recoiling of the filament in *Siboglinum ekmani*, and I have myself observed the same in all three species of athecanephrians described above. Another theory is put forward by Carlisle (in Ivanov, 1963, pp. 97-98) who finds it improbable that spermatophores, which are few in number, should be shed freely in the water and then be carried haphazardly by the currents to the female; he finds it more likely that the spermatophores are actively transferred to the female, probably by means of the tentacles.

To get some idea about the numbers of spermatophores I have opened the right sperm-duct of a specimen of *Oligobrachia floridana*. The fore-body of the animal was 2.5 mm long and the distal, unfolded part of the sperm-duct (spd⁴ in Ivanov, 1963, fig. 60) 22.5 mm long. The most distal 5.2. mm did not contain any spermatophores, but the remaining part of the sperm-duct contained 576 apparently fully formed spermatophores. The sperm-duct of the left side seemed to contain about the same number, and it must therefore be concluded that the Pogonophora, contrary to the statement of Carlisle, form an unusually high number of spermatophores.

Nothing seems to be known about the number of spermatozoa contained in each spermatophore, but since each batch of eggs in the tube of the female consists of less than 50 eggs it is probable that one spermatophore contains a sufficient number of spermatozoa for the fertilization of all the eggs in one batch. This indicates that the Pogonophora can afford the relatively great loss of spermatophores which must be connected with this unprotected transference.

Thus I find it probable that the spermatophores are shed in great numbers into the water and float aided by the long, uncoiled filament. But the other theory cannot be entirely disregarded before positive evidence has been gained, e.g., by catching the spermatophores in the water just over the bottom, or, even better of course, by watching the process on living animals in the aquaria.

SUMMARY

Four new species of Pogonophora have been found on a muddy bottom at 200 metres depth off Miami Beach, Florida. The bottom temperature was ascertained to be about 8.5°C. A list of the associated fauna is given in Table 1.

The new species belong to the genera *Oligobrachia*, *Nereilium*, *Siboglinum*, and *Siphonobrachia*, gen. nov., respectively. The distinctive characters of *Oligobrachia* and *Nereilium* are discussed and it is concluded that species of *Oligobrachia* are characterized by having 4-9 tentacles and a rather opaque fore-body, while species belonging to *Nereilium* have 2 tentacles and a rather transparent fore-body. The new genus belongs to the family Lamellisabellidae and is distinguished from *Lamellisabella* by having "normal" plaques instead of the horse-shoe-shaped ones of that genus.

The distinctive characters of the orders Athecanephria and Thecanephria are discussed and it is concluded that only the internal anatomy of the fore-body can give a fully reliable distinction.

The number of spermatophores in one specimen of *Oligobrachia floridana* is judged to about 1100 and this very high number gives strength to the theory that the spermatophores are shed free into the water and carried to the female by the current. One spermatophore is believed to contain a sufficient number of spermatozoa for the fertilization of a whole batch of eggs, and the pogonophores seem thus to be able to afford the big wastage of spermatophores which is probably connected with this way of transference of the sperm.

SUMARIO

CUATRO NUEVAS ESPECIES DE POGONÓFORA DEL OCÉANO ATLÁNTICO FRENTE A LA FLORIDA

Cuatro nuevas especies de Pogonófora han sido encontradas en un fondo fangoso a 200 m de profundidad frente a Miami Beach, Florida, E.E.U.U. La temperatura del fondo se calculó alrededor de 8.5°C. Una lista de la fauna asociada a ellas es dada en la Tabla 1.

Las nuevas especies pertenecen a los géneros: *Oligobrachia*, *Nereilium*, *Siboglinum* y *Siphonobrachia*, gen. nov., respectivamente. Se discuten los caracteres distintivos de *Oligobrachia* y *Nereilium* y se concluye que las especies de *Oligobrachia* se caracterizan por tener de 4-9 tentáculos y un cuerpo anterior más bien opaco, mientras que las especies pertenecientes a *Nereilium* tienen 2 tentáculos y un cuerpo anterior más bien transparente. El nuevo género pertenece a la familia Lamellisabellidae y se caracteriza con respecto a *Lamellisabella* por tener placas "normales" y no en forma de herradura como las de ese género.

Se discuten los caracteres distintivos de los órdenes Athecanephria y Thecanephria y se concluye que solamente la anatomía interna del cuerpo anterior puede dar una distinción completamente segura.

El número de espermatóforos en un ejemplar de *Oligobrachia floridana* se juzga en alrededor de 1100 y este número tan alto da fuerza a la teoría de que los espermatóforos son liberados en el agua y llevados por la

corriente hasta las hembras. Un espermatóforo se cree que contiene un número suficiente de espermatozoos para la fertilización de una puesta de huevos, y los pogonóforos lucen ser capaces de producir el gran desperdicio de espermatóforos que esta forma de transferencia de esperma probablemente implica.

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